CLAIMS

I/We claim:

[c1] 1. A method for sizing an aircraft system comprising:

selecting at least one design condition;

identifying at least one aircraft angle of attack;

selecting a spanwise lift coefficient distribution corresponding to the at least one design condition and the at least one aircraft angle of attack, the spanwise lift coefficient distribution extending over a spanwise portion of an airfoil, the spanwise portion including a plurality of spanwise locations and a leading edge device arrangement, the leading edge device arrangement having at least a portion of at least one leading edge device; and

determining a leading edge device chord length at each of the plurality of spanwise locations, such that when the airfoil is operated at the at least one design condition and the at least one aircraft angle of attack, the airfoil will provide at least approximately the selected spanwise lift coefficient distribution over the spanwise portion.

[c2] 2. The method of claim 1, further comprising an aircraft, the airfoil being coupled to the aircraft.

[c3] 3. The method of claim 1 wherein the at least one design condition includes at least one of a physical characteristic of an aircraft, a dynamic characteristic of the aircraft, and a characteristic of an environment in which the aircraft operates.

[c4] 4. The method of claim 1, further comprising tapering a chord length of the leading edge device arrangement in approximately opposite spanwise directions, the taper in each direction varying the chord length in a manner that is

at least approximately proportional to the manner in which the leading edge device chord length determined for each of the plurality of locations varies across the spanwise portion.

[c5] 5. The method of claim 1, further comprising arranging a plurality of leading edge devices, each leading edge device having an approximately constant chord length, and wherein the plurality of leading edge devices are arranged such that the leading edge device chord length at each of the plurality of locations is at least approximately proportional to the leading edge device chord length determined for each of the plurality of locations.

[c6] 6. A method for sizing an aircraft system comprising:

identifying a taper for each of at least two tapered portions of a leading edge device arrangement of an airfoil, each tapered portion having a plurality of spanwise locations, the leading edge device arrangement including at least a portion of at least one leading edge device; and

selecting a leading edge device chord length or chord length fraction at each of the plurality of spanwise locations wherein the at least two tapered portions include:

a first tapered portion having a chord length or chord length fraction that tapers in a first spanwise direction; and

a second tapered portion having a chord length or chord length fraction that tapers in a second spanwise direction approximately opposite the first direction.

[c7] 7. The method of claim 6, further comprising an aircraft, the airfoil being coupled to the aircraft.

[c8] 8. The method of claim 6, further comprising:

selecting a plurality of leading edge devices, each having an approximately constant chord length; and

arranging the plurality of leading edge devices to create the tapered portions.

[c9] 9. The method of claim 6 wherein at least a portion of a single leading edge device includes the first and second tapered portions.

[c10] 10. The method of claim 6 wherein the first tapered portion includes at least a portion of at least one first leading edge device and the second tapered portion includes at least a portion of at least one second leading edge device.

[c11] 11. A method for sizing an aircraft system comprising:

selecting at least one design condition for an airfoil, the airfoil having a spanwise portion with a plurality of spanwise locations, the spanwise portion having a leading edge device arrangement with at least a portion of at least one leading edge device;

identifying a spanwise distribution of aircraft angles of attack corresponding to local maximum lift coefficients at the plurality of spanwise locations when the airfoil is operated at the at least one design condition; and

sizing a leading edge device chord length at each of the plurality of spanwise locations to at least approximately match the identified spanwise distribution of aircraft angles of attack.

[c12] 12. The method of claim 11, further comprising an aircraft, the airfoil being coupled to the aircraft.

[c13] 13. The method of claim 11 wherein the at least one design condition includes at least one of a physical characteristic of an aircraft, a dynamic characteristic of the aircraft, and a characteristic of an environment in which the aircraft operates.

[c14] 14. The method of claim 11, further comprising tapering a chord length of the leading edge device arrangement in approximately opposite spanwise directions, the taper in each direction varying the chord length in a manner that is at least approximately proportional to the identified spanwise distribution of aircraft angles of attack

[c15] 15. The method of claim 11, further comprising arranging a plurality of leading edge devices, each leading edge device having an approximately constant chord length, and wherein the plurality of leading edge devices have a distribution of leading edge device chord lengths at least approximately proportional to the identified spanwise distribution of aircraft angles of attack

[c16] 16. A method for sizing an aircraft system comprising:

selecting at least one design condition for an airfoil, the airfoil having a spanwise portion with a plurality of spanwise locations, the spanwise portion having a leading edge device arrangement with at least a portion of at least one leading edge device;

identifying a spanwise distribution of aircraft angles of attack corresponding to local maximum lift coefficients over the spanwise portion when the airfoil is operated at the at least one design condition;

determining one aircraft angle of attack that is at least approximately equal to a smallest aircraft angle of attack in the spanwise distribution of aircraft angles of attack; and

sizing a leading edge device chord length at each of the plurality of spanwise locations such that the local maximum lift coefficient at each spanwise location occurs at an aircraft angle of attack that is at least approximately equal to or greater than the one aircraft angle of attack.

[c17] 17. The method of claim 16, further comprising an aircraft, the airfoil being coupled to the aircraft.

[c18] 18. The method of claim 16 wherein the at least one design condition includes at least one of a physical characteristic of an aircraft, a dynamic characteristic of the aircraft, and a characteristic of an environment in which the aircraft operates.

[c19] 19. The method of claim 16, further comprising tapering a chord length of the leading edge device arrangement in approximately opposite spanwise directions, the taper in each direction varying the chord length in a manner that is at least approximately proportional to the sized leading edge chord lengths at the plurality of spanwise locations.

[c20] 20. The method of claim 16, further comprising arranging a plurality of leading edge devices, each leading edge device having an approximately constant chord length, and wherein the plurality of leading edge devices are arranged such that the leading edge device chord length at each of the plurality of spanwise locations is at least approximately proportional to the sized leading edge device chord lengths at the plurality of spanwise locations.

[c21] 21. An aircraft system comprising:

an airfoil having a spanwise portion, the spanwise portion having a plurality of spanwise locations; and

a leading edge device arrangement coupled to the spanwise portion, the leading edge device arrangement including at least a portion of at least one leading edge device, the at least one leading edge device being deployable with a retracted position and at least one extended position, the leading edge device arrangement having at least two tapered portions, including:

a first tapered portion having a chord length or chord length fraction that tapers in a first spanwise direction; and

a second tapered portion having a chord length or chord length fraction that tapers in a second spanwise direction approximately opposite the first direction.

[c22] 22. The system of claim 21, further comprising an aircraft, the airfoil being coupled to the aircraft.

[c23] 23. An aircraft system comprising:

an airfoil having a spanwise portion, the spanwise portion having a plurality of spanwise locations; and

a leading edge device arrangement coupled to the spanwise portion, the leading edge device arrangement including at least a portion of at least one leading edge device, the leading edge device arrangement having at least two tapered portions, including:

a first tapered portion having a chord length or chord length fraction that tapers in a first spanwise direction; and

a second tapered portion having a chord length or chord length fraction that tapers in a second spanwise direction approximately opposite the first direction.

[c24] 24. The system of claim 23 wherein the leading edge device arrangement includes a plurality of leading edge devices, each leading edge device having an approximately constant chord length, and wherein the plurality of leading edge devices are arranged to create the taper of the leading edge chord length or chord length fraction in the first and second directions.

[c25] 25. The system of claim 23 wherein the first tapered portion includes at least a portion of at least one first leading edge device and the second tapered portion includes at least a portion of at least one second leading edge device.

[c26] 26. The system of claim 23 wherein the leading edge device arrangement includes at least a portion of a single leading edge device.

[c27] 27. The system of claim 23, further comprising an aircraft, the airfoil being coupled to the aircraft.

[c28] 28. The system of claim 23 wherein the at least one leading edge device is deployable, having a retracted position and at least one extended position.

[c29] 29. An aircraft system comprising:

an airfoil having a spanwise portion, the spanwise portion having a plurality of spanwise locations; and

a leading edge device arrangement coupled to the spanwise portion, the leading edge device arrangement including at least a portion of at least one leading edge device, wherein a leading edge device chord length at each of the plurality of spanwise locations is at least approximately equal to the smallest leading edge device chord length required to provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack.

[c30] 30. The system of claim 29 wherein the leading edge device arrangement includes a plurality of leading edge devices, each leading edge device having an approximately constant chord length, and wherein the plurality of leading edge devices are arranged to be at least approximately proportional to the smallest leading edge device chord length required to provide a local maximum lift coefficient at each of the plurality of spanwise locations when the airfoil is operated at the at least one selected design condition and the selected aircraft angle of attack.

[c31] 31. The system of claim 29 wherein the leading edge device arrangement has at least two tapered portions, including:

a first tapered portion wherein the leading edge device chord length is tapered in a first spanwise direction; and

a second tapered portion wherein the leading edge device chord length is tapered in a second spanwise direction approximately opposite the first direction, the leading edge device chord length varying in a manner at least approximately the same as the manner in which the approximately smallest leading edge device chord length required to provide the local maximum lift coefficient varies across the spanwise portion.

[c32] 32. The system of claim 29, further comprising an aircraft, the airfoil being coupled to the aircraft.

[c33] 33. The system of claim 29 wherein the at least one selected design condition includes at least one of a physical characteristic of an aircraft, a dynamic characteristic of the aircraft, and a characteristic of an environment in which the aircraft operates.

[c34] 34. The system of claim 29 wherein the at least one leading edge device is deployable, having a retracted position and at least one extended position.

[c35] 35. An aircraft system comprising:

an airfoil having a spanwise portion, the spanwise portion having a plurality of spanwise locations; and

leading edge high lift means for increasing airfoil performance at high aircraft angles of attack positioned proximate to the spanwise portion wherein a high lift means chord length at each of the plurality of spanwise locations is at least approximately proportional to an approximately smallest high lift means chord length required to

provide a local maximum lift coefficient when the airfoil is operated at at least one selected design condition and a selected aircraft angle of attack.

[c36] 36. The system of claim 35 wherein the leading edge high lift means includes at least one leading edge device having at least two tapered portions tapered in opposite spanwise directions.

[c37] 37. The system of claim 35, further comprising an aircraft, the airfoil being coupled to the aircraft.

[c38] 38. The system of claim 35 wherein the at least one selected design condition includes at least one of a physical characteristic of an aircraft, a dynamic characteristic of the aircraft, and a characteristic of an environment in which the aircraft operates.

[c39] 39. An aircraft system comprising:

an airfoil having a spanwise portion, the spanwise portion having a plurality of spanwise locations; and

a leading edge device arrangement coupled to the spanwise portion, the leading edge device arrangement including at least a portion of at least one leading edge device, wherein a leading edge device chord length at each of the plurality of spanwise locations is at least approximately proportional to a leading edge device chord length at each location determined to provide a selected lift coefficient distribution when the airfoil is operated at at least one selected operating condition and at least one selected aircraft angle of attack.

[c40] 40. The system of claim 39 wherein the leading edge device arrangement includes a plurality of leading edge devices, each leading edge device having an approximately constant chord length, and wherein the plurality of

leading edge devices are arranged to be at least approximately proportional to the leading edge device chord length at each location determined to provide the selected lift coefficient distribution.

[c41] 41. The system of claim 39 wherein the leading edge device arrangement has at least two tapered portions, including:

a first tapered portion wherein the leading edge device chord length is tapered in a first spanwise direction; and

a second tapered portion wherein the leading edge device chord length is tapered in a second spanwise direction approximately opposite the first direction, the leading edge device chord length varying in a manner at least approximately the same as the manner in which the leading edge device chord length at each location determined to provide the selected lift coefficient distribution varies across the spanwise portion.

[c42] 42. The system of claim 39, further comprising an aircraft, the airfoil being coupled to the aircraft.

[c43] 43. The system of claim 39 wherein the at least one selected design condition includes at least one of a physical characteristic of an aircraft, a dynamic characteristic of the aircraft, and a characteristic of an environment in which the aircraft operates.

[c44] 44. The system of claim 39 wherein the at least one leading edge device is deployable, having a retracted position and at least one extended position.

[c45] 45. An aircraft system comprising:

an airfoil having a spanwise portion, the spanwise portion having a plurality of spanwise locations; and

a leading edge device arrangement coupled to the spanwise portion, the leading edge device arrangement including at least a portion of at least one leading edge device, wherein a leading edge device chord length at each of the plurality of spanwise locations is at least approximately proportional to a leading edge device chord length at each location determined to provide a distribution of aircraft angles of attack corresponding to local maximum lift coefficients when the airfoil is operated at at least one selected operating condition.

[c46] 46. The system of claim 45 wherein the leading edge device arrangement includes a plurality of leading edge devices, each leading edge device having an approximately constant chord length, and wherein the plurality of leading edge devices have a combined distribution of chord lengths at least approximately proportional to the determined leading edge device chord lengths at each spanwise location.

[c47] 47. The system of claim 45 wherein the leading edge device arrangement has at least two tapered portions, including:

a first tapered portion wherein the leading edge device chord length is tapered in a first spanwise direction; and

a second tapered portion wherein the leading edge device chord length is tapered in a second spanwise direction approximately opposite the first spanwise direction, the first and second portions having a combined distribution of chord lengths at least approximately the same as the determined leading edge device chord lengths.

[c48] 48. The system of claim 45, further comprising an aircraft, the airfoil being coupled to the aircraft.

[c49] 49. The system of claim 45 wherein the at least one selected design condition includes at least one of a physical characteristic of an aircraft, a dynamic

characteristic of the aircraft, and a characteristic of an environment in which the aircraft operates.

[c50] 50. The system of claim 45 wherein the at least one leading edge device is deployable, having a retracted position and at least one extended position.